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VALVE CONNECTOR

The invention concerns a valve connector for inflation valves of vehicle tyres according to the introduction to claim 1.

For reasons of clarity, some of the standards used will be cited. In the ISO standard No 10475:1992(E), thread for tyre inflation valves of vehicles is described. The most used threads are designated 5V2 (DIN: Vg 5,2), which has a nominal diameter of 5.2 mm and a pitch of 1.058 mm, and 8V1 (DIN: Vg 8), which has a nominal diameter of 7.7 mm and a pitch of 0.794 mm respectively. These thread types are used in the valve types of Dunlop-Woods, Sclaverand or Schräder. The last mentioned valve type is frequently used on common cars, where a spring-loaded pin head in the valve plug must be kept down in preparation of the passage of air, while pumping a tyre. For this purpose, the valve connector must be equipped with suitable means, which can serve this aim. Moreover, suitable means, e.g. a contra valve or the like, must be used to ensure that loss of air is avoided when activating the valve plug pin. The Sclaverand valve has - just like the Dunlop-Woods valve - the distinctive character that its plug pin is solely opened by air pressure. The necessary air pressure for opening a Sclaverand valve is up to 16 bar, and the valve is mostly used in connection with high-pressure tyres with a pressure of up to 16 bar. The opening pressure for the Dunlop-Woods valve is approximately 4 bar, which ensures that it is easier to open.

Well-known valve connectors (e.g. GB-B-977,139) can only be connected to the Dunlop-Woods valve type and/or the Sclaverand valve type, or the Schräder valve type.

A well-known connector for a Schräder valve is of the type, where a rubber cylinder is tightly squeezed against the stem by means of a lever, which axially compresses the rubber cylinder. Consequently, the rubber cylinder is squeezed radially against the stem. With reference to different valve diameters, it is necessary, that auxiliary equipment (nut 6) is screwed onto or out of the valve thread to reduce or increase the internal diameter in advance to ensure the establishment of a connection from the valve connector to other valve diameters. Loose parts can disappear and can be loosened when used, if the pump hose is turned, so that the connection is no longer air-tight. The disadvantage of this connector type is that the user has to apply much strength when using the lever. It is necessary to use both hands to stabilize the (dis)connection.

GB patent application No 39808/77 shows a universal valve connector which can be screwed on all valve types. The thread (4) corresponding to 8V1 also keeps the bushing (26) in position. The bushing (26) has an internal thread (30) corresponding to 5V2 for Sclaverand or Dunlop-Woods valves. The plug pin of the Schräder valve is opened mechanically by means of a stationary pin indicated with (12). The disadvantage of this connector type is that the bushing (26) with a 5V2 thread has to be removed before connecting to a Schräder valve, and also that the bushing (26) must be mounted again before connecting to a Dunlop-Woods or Sclaverand valve. Also in this case loose parts are used. They can disappear and loosen when used, if the pump hose is turned, resulting in an untight connection.

From DE-B 38 19 771, a universal connector on a handpump with two coupling holes is known: one for Dunlop-Woods and Sclaverand valves and one for Schräder valves of which the plug pin is opened mechanically. The disadvantage of this way of coupling is firstly, that it cannot be fastened to a valve and secondly, that it can only be used in a certain position, where the coupling hole is turned almost vertically upwards, and finally that the user has to find out which of the two holes to use for the valve in question.

Another well-known universal valve type, which, apparently, does not exist in the patent literature, is of the same type as the one of the above mentioned GB patent application No 39808/77. This rubber cylinder consists of two adjacent parts of different diameter and length, fitting on 5V2 and 8V1 threads, respectively. Axially, proximally staggered on the centre line of the holes it is possible to mount a means, which can open the plug pin of a Schräder valve. The disadvantage of this coupling is partly that both hands must be used to stabilize the (dis-)connection of Dunlop-Woods or Sclaverand valves and partly that the rubber cylinder must be taken out of the housing and turned upside down to make connection to valves with different thread types possible, so that the coupling place for connecting the valve is always positioned closest to the opening of the coupling hole. Also, the pin which mechanically opens the Schräder valve has to be turned in the above-mentioned operation. This is a problem for the ordinary user, as both means must be positioned correctly in relation to each other in order to be able to connect the coupling to a valve: combinatorily, there are four possibilities to select from, which can only be done correctly if a user manual is available. Apart from that, the above-mentioned means can be lost, loosened or disappear in the said operation.

Inflating a tyre is a problem to many people, especially if the tyres have different valve types, and only one pump has to be used. This is the case in most house-holds. The aim of the invention is to provide a valve

connector which fits on all current valve types, which is easy to use, and which is cheap. The connector will preferably be used with existing pumps.

According to the invention this task is solved by means of the provisions in the characterising part of claim 1.

By a connector for inflation valves of vehicle tyres, where the connector consists of a housing connected to a pressure source, preferably a hand or foot pump, and with a coupling hole with a diameter corresponding to the diameter of the valve to which it is connected, where the coupling hole is equipped with a securing means for securing on the valve and a sealing means against valves of different sizes, the invention is provided by the fact that the sealing means is mounted coaxially in the connector housing and is established on at least two parallel seperate levels having the centre line of the connector housing, which is coaxial to the centre line of the valve when used, as its normal, where the internal diameter of the sealing means approximately corresponds to the external diameter of the present valve dimensions, on which the connector is mounted when used, that the sealing means which is nearest to the opening of the coupling hole in the connector housing has the biggest diameter, while the sealing means which is farthest from the opening of the coupling hole in the connector housing has the smallest diameter, and diameters between the extremes are lying in corresponding seperate distances between these extremes. The coupling place on a valve, which is to be connected, is positioned against a sealing surface on the sealing means in the coupling hole of the concerned valve. The connector has only one coupling hole. The use of it is therefore simple, even without a user manual, and loose nipples are superfluous. Therefore, a connection can always be established in only one operation.

In an appropriate construction example of the invention, it is suggested that the securing means is a rotational bushing mounted on the housing, which is equipped with a thread in the coupling hole, which fits on the respective valves, and which is sealed with the sealing means against the connector housing, which is farthest from the coupling hole in the connector housing. The connector can be positioned here on the valve with an airtight connection, which does not become untight when the connected hose is turned. In addition, mounting is quickly accomplished without applying significant strength. (Dis)connecting of the coupling can be done using only one hand.

To reduce the wear of the gasket seal surface in the connector housing and by that also to reduce the force by means of which the rotational bushing has to be turned, and furthermore to ensure a reliable sealing against valves with 5V2 thread, a still more appropriate construction example suggests that the innermost thread is provided by a bushing with a 5V2 thread, where the bushing is embedded and - slightly - axially sliding in a taper milling in the rotational coupling bushing and is coupled rotational-free to the coupling bushing by means of a set of ribs, which are distributed around the bushing circumference, and which are geared into corresponding grooves in the coupling bushing, and that the sealing means is radially stepped and rests on an also stepped milling in the connector housing. This ensures that frictional forces do not occur between the gasket seal and the coupling bushing during the main part of its fastening and unscrewing, whereas the coupling bushing is pulling the connector housing and its gasket seal against the valve when tightening. Tightening occurs against the core of the valve thread and is stabilized as a result of the reduced radius of the inner, stepped part of the gasket seal.

In connection with the (dis)connection with only one hand, almost the same is valid if the connector is provided by means of temporary thread, i.e. created by squeezing a rubber cylinder against the existing valve thread of which the securing means and sealing means in a well-known way consist of the bushing of a deformable material positioned in the housing, preferably a rubber type material, and that a piston is mounted proximally to the valve and the bushing which has two extremes to establish an axial compression and release of the bushing, and also a lever for activating the piston, where the axis of the lever is placed perpendicularly to the centre line and excentrical with this, and that the lever for activating the piston is turned from a position forming an angle Ψ with the centre line to a position almost perpendicular to the centre line, where a locking means is working together with a corresponding locking means, which, as an example, is constructed as a cross bar on the lever. With this construction example of the connector, it is possible to mount this, using just one hand, as the lever is taken down to its locking position by just a simple squeezing of the lever and the hose connection on the connector housing. By this action the piston is pressed against the rubber cylinder, which is tightly squeezed radially against the concerned valve. This construction example is designated: a torque-moment-free (dis-)connection, as the valve may not carry any torque-moments by the

(dis-)connection. Connection to almost all valves is possible, as this connector type can open such a plug pin in a Schräder valve, which is opening at an air pressure of approximately 5-6 bar. The air pressure in the pump hose is of the same magnitude as when a high-pressure tyre provided with a Sclaverand valve is inflated. This is optimally achieved by using a high-pressure hand or foot-operated bicycle pump. There are plug pin types which cannot be opened by means of air pressure of an ordinary bicycle pump (e.g. 10 bar max.). Connecting can be done easily and comfortably in two ways. Either the last mentioned plug type is being replaced with the first mentioned one and the construction examples of the invention without a pin are being used as a connector, or the plug can be opened according to an appropriate construction example of the invention by a pin placed in continuation of and coaxially to the centre line of the connector housing, which is transported by axial shifting from a position farthest from the valve (fig. 4A) to activate the central pin head of the plug (fig. 4B). By this said construction example, the necessary pumping force is considerably lower, when a Schräder valve is to be inflated, because no air pressure is used to open of the valve. Inflation can therefore be done with an ordinary bicycle pump.

The Schräder valve has the biggest major diameter of the external thread (thread type ISO 4570/3 8V1, ISO 10475:1992-12V1 resp.) and the coupling place is closest to the opening of the coupling hole. The Dunlop-Woods plugs and the Sclaverand valves have the same thread type, where the major diameter of the external thread (thread type ISO 4570/2 5V2) is smaller than the minor diameter of internal thread 8V1. Therefore, it is possible that the Dunlop-Woods plug type and the Sclaverand valve type can pass both the coupling place of 8V1 threads and 12V1 threads. Consequently, the coupling place of the connecting of 5V2 thread is farthest from the opening of the coupling hole. The 5V2 thread of the Dunlop-Woods plug (both the type which is DIN normed and the type which in daily language is called the 'ball valve'), is sufficiently sticking out over the nut 8V1 which is mounting the plug to the stem and of which the major diameter is less than the minor diameter of the internal thread for the 12V1 thread in the bushing. There is, therefore, enough space for at least two thread types each with a corresponding seal ring. The same applies for the two squeezing connections, according to the invention, where the connector is squeezed to form a temporary thread. The said 8V1 nut cannot pass the coupling place of the Schräder valve. That is due to the fact that the major diameter of the said nut is bigger than the diameter of the biggest hole in the rubber cylinder (a major diameter of external thread 8V1). The beginning of the coupling place of the 5V2 thread is at distance a from the opening of the coupling hole. As the load on the connection is low, it is not necessary to use the entire length of the internal thread, as generally accepted rules say 0.8 x of the size of the coupled external thread. This rule is based on mechanical constructions which are high-loaded and where the thread is fastened by a wrench. It is therefore possible that the coupling place of the 5V2 thread is behind the coupling place of the 8V1 thread.

The invention can exist in a number of construction examples which appear from the depending claims. The invention is explained in details below by means of drawings. On the drawing is show with

Fig. A	an example of a well-known connector, where two loose nipples are put upside down dependent on the valve type, to be connected to the hose,
fig. 1	the universal connector in the first construction example connected to the hose of a (high-pressure) foot pump, where the connector is screwed on the valve and a Schräder valve type can be opened by air pressure,
fig. 2	the connector according to fig. 1 in a second construction example, where the hose nipple is in continuation of the centre line,
fig. 3	the connector according to fig. 1 in a third construction example where the bushing with a 5V2 thread and a gasket sealing for Schräder can slide parallel to the centre line,
fig. 3	a rendering of details of the connector according to fig. 3A, (section A-A),
fig. 4A,B	universal connector according to fig. 1 in a fourth construction example where the coupling is screwed on the valve, and a Schräder valve can be opened mechanically by means of a pin, which is shown in the top and bottom position,
fig. 5A,B	universal connector according to fig. 4A, 4B in a fifth construction example, where the pin feed mechanism is constructed in a different way and where the

	pin is shown in the top and bottom position, respectively,
fig. 6A,B	universal connector according to fig. 5A, 5B in a sixth construction example, where the pin feed mechanism is constructed with a big thread pitch, and where the pin is shown in the top and bottom position, respectively,
fig. 7	a rendering of details of the connector according to fig. 6A (section X - X) and fig. 6B, (section Y-Y),
fig. 8	feed cylinder of the construction example according to fig. 6A, 6B, (section Z-Z),
fig. 9	universal connector in a seventh construction example connected to a hose of a (high-pressure) foot pump, where the coupling is squeezed on the valve and a Schräder valve can be opened by means of air pressure,
fig. 10	universal connector in a ninth construction example connected to a hose of a (high-pressure) foot pump, where the connector is squeezed on the valve and a Schräder valve can be opened by means of air pressure,
fig. 11A,B	universal connector in a tenth construction example, which is a further development of the seventh construction example of fig. 9, where the coupling is connected to a hose of a foot pump, and where the coupling is squeezed on the valve, and a Schräder valve can be opened mechanically by means of a movable pin, which is in the top and bottom position, respectively,
fig. 12A,B	universal connector in an eleventh construction example, which is a further development of the ninth construction example of fig. 10, where a Schräder valve can be opened mechanically by means of a movable pin, which is in the top and bottom position, respectively,
fig. 12C	section A-A according to fig. 12A resp. section B-B according to fig. 12B - none-essential details are not shown,
fig. 13	universal connector in an eighth construction example built-in on the end of a (high-pressure) pump, where the connector is squeezed on the valve, and a Schräder valve is opened by means of air pressure,
fig. 14A,B	universal connector in a twelfth construction example built-in on the end of a (high-pressure) hand pump, where the coupling is squeezed on the valve, and a Schräder valve is opened by means of a built-in movable pin, which is shown in the top and bottom position, respectively,
fig. 15	universal connector according to fig. 6A t/m 8 connected to a Dunlop-Woods valve with a DIN normed plug,
fig. 16	universal connector according to fig. 6A t/m 8 connected to a Dunlop-Woods valve with a ball valve as plug,
fig. 17	universal connector according to fig. 6A t/m 8 connected to a Sclaverand valve,
fig. 18	universal connector according to fig. 6A t/m 8 connected to a Schräder valve where the pin is opening the plug pin,
fig. 19	universal connector according to fig. 12A,B,C connected to a Dunlop-Woods valve with a DIN normed plug,
fig. 20	universal connector according to fig. 12A,B,C connected to a Dunlop-Woods valve with a ball valve as plug,
fig. 21	universal connector according to fig. 12A,B,C connected to a Sclaverand valve,
fig. 22	universal connector according to fig. 12A,B,C connected to a Schräder valve where the pin is opening the plug pin.

A first construction example, which is shown in fig. 1, is a housing 3 which is connected to a pump hose 1 from a (high-pressure) pump by means of a ring clamp 2. At the coupling hole 5 a bushing 6 is mounted, which can turn freely in relation to the housing 3, and which is provided with at least two types of internal

threads 7, 9: 5V2: 7 and 8V1: 9. Both threads end in a rubber sealing 12, 13. The upper of these gasket seals 12 is placed on the border surface 14 between the housing 3 and the bushing 6 and is tightening this crossing. All connections are air-tight, because the coupling place is positioned against the sealing surface 12 and 13 on the connected valve thread: a fixed connection is the result which is fastened enough to prevent the hose 1 from turning around. Only a few turns of bushing 6 are enough to fasten the connection. As the housing 3 here is bent in an angle α of e.g. 30°- 60° in relation to the centre line 4 of the coupling hole 5, the hose 1 can be held in the handpalm of the user, while the bushing 6 is turned between the thumb and forefinger of the same hand.

A second construction example is a connector identical with the first construction example. The housing 16 is not bent here and is connected to a hose 17 from a (high-pressure) hand pump. As the housing is not bent here, it can be kept in the pump handle during transport.

A third construction example, shown in fig. 3A and 3B, is an improvement of the connector from fig. 1 and fig. 2, as the bushing 191 now turns freely and without friction around the housing 190 until a valve is connected. The (dis-) connection is thus achieved in a quicker and easier way. This is made possible by a small space b together with the fact that the lowest gasket seal 194 and the bushing 193 with the 5V2 thread are moveable parallel along with the centre line of the valve. Bushing 193 is turning together with bushing 191, as the first mentioned bushing is equipped with at least two ribs 196 which fit into the corresponding grooves 197 in the bushing 191. The top sealing 192 is embedded in the housing 190 and is tightening there. When a valve with a 5V2 thread is being connected, the bushing 193 is pushed upwards, until it meets the top seal 192. When the valve by turning the bushing 191, and thereby also the bushing 193, is directed into the top seal 192, it is tightening there on the minor diameter of the thread and the valve is being stopped on the edge 198 of the air supply hole 75, after which the bushing 193 with the 5V2 thread is pressed down to the bushing 191 (shown with 197). The diameter of the sealing means 200 is reduced towards the connector housing 190 to increase the tightening, when a 5V2 thread has been screwed on the valve. To facilitate the mounting, the sealing means can be equipped with a chamfering 203 on the side towards the valve. When disconnecting, a reverse sequence takes place. When a Schräder valve is connected, the gasket seal 194, is pushed against the top gasket seal 192 together with the bushing 193, whereby a tight connection is obtained. When disconnecting, a reverse sequence takes place.

A fourth construction example, shown in fig. 4A and 4B, is an improvement of the connector, so it can also be used for all Schräder valves. It is a connector with a pin, which can mechanically open the plug pin of the Schräder valves, which cannot be opened by means of air pressure, created by e.g. a bicycle pump up to max. 10 bar. It is also reducing the necessary pumping force when a tyre with a Schräder valve has to be inflated, so that a common bicycle pump can be used for inflating. The pin 21 moves through the top of the housing 19 and can be fastened in two positions. The top position 18 makes connection of all valve types possible, whereas it can only be connected to a Schräder valve in the bottom position 32, where the pin 21 is pressing its pin head. As it is desirable to have a quick shift from one position to another, pin 21 is provided with a thread 25 with a comparatively big pitch. Sealing is done with two gasket seals 26, 27, placed just behind the thread ends on pin 21. These fit in conical shaped holes in the housing and are thus centering the pin in relation to the plug pin of the Schräder valve. Centering is also necessary for the pin 21 to pass the coupling place for the 5V2 thread. Therefore the other side of the bottom gasket seal 26 is equipped with a cone 30, as centering occurs in the last stage of the fastening. The pin 21 is made of e.g. impact-proof material, whereas the top 31 is made of an elastic material, so that all shocks can be caught here. The position of the pin shows the user the valve types to which the connector can currently be coupled. Pin 21 can move independently of whether the connector is fastened or not. A necessary condition for applying such a pin 21 is that a not shown contravalve is inserted before or in the connector housing seen in the airflow direction, preventing an outflow of air from the Schräder valve when pin 21 is activated.

A fifth construction example, shown in fig. 5A and 5B, is an improvement of the fourth construction example. The pin 161 is now built-in in knob 162, which can turn in the top of the housing 164. Shocks on the knob 162 will be transferred to the housing 164 and the pin 161 will be protected by that. Sealing is now done with only one gasket seal 168, which is positioned between the underside of the knob 162 and pin 161. When the knob is turned, the pin is shifted coaxially with the centre line 4 of the coupling hole 5 as two fins 166 which run in two slits 167 of this hole prevent the rotation of the pin 161. To reduce the friction, the pin diameter is slightly reduced between the extremes.

A sixth construction example, shown in fig. 6A - 8, is an additional improvement of the fifth construction example. The pin 40 is also built-in, and no leakage arise because of dirt. The thread pitch is still bigger, so that the pin can change from one postion to the other more quickly. The pin 40 moves by means of a turning knob 43 which is mounted on top of the housing 35. The feed mechanism of the pin 40 is known e.g. from lipsticks. The coupling hole of the housing is provided with internal thread. At the underside, the knob is provided with a cylinder 48, which can turn in the periphery of the coupling hole 5. In the cylinder wall, there are two slits 49, 50 parallel with the centre line 4 of the coupling hole 5. Pin 40 can move axially in the cylinder 48 as two taper shaped protrusions 51, 52 are placed on the side of the pin 40, which fit in the said slits 49, 50 and thread 67. During the main part of the movement, the thread pitch is so big that it is a feed thread. Therefore, the threadforces are low and the slits of the cylinder can push the protrusions 51, 52 of the pin in the thread 67. When the knob 43 is turned, the pin 40 is moving and rotating from the one extreme position 18 to the other extreme position 32. The pitch can be variable so that the pin 40 can carry a load from the plug pin of the Schräder valve in the bottom position 32 and it can rest in the top position, so that the pin 40 cannot move. Both slits 49, 50 have at both ends slits 55, 56, 57, 58 diametrically opposite each other. Protrusions 51, 52 from the pin 40 are transferring a load force perpendicular to the centre line 4 of the coupling hole to the cylinder wall. Knob 43 is fixed at the end of the turn as the protrusions 51, 52 are led into the slits 55, 56, 57, 58 placed opposite each other. It is fixed when a bulb 47 on the house 35 is locked in a corresponding jut 46 in the knob 43. Otherwise, the user could turn the knob 43 with a little bumb and push the protrusions 51, 52 of the pin 40 out of the above-mentioned slits 55, 56, 57, 58, after which the pin 40 could move freely. The user feels a little 'click', which means that the turning knob has been locked in the right position. The user can directly see what kind of valve it can be connected to as the housing 35 at the ends of the knob turn is equipped with valve symbols 71, 72, 73. The pitch is in general so big that the knob only need to be turned approx. 240°. Here a contravalve is also necessary.

A seventh construction example, shown in fig. 9, is a housing 77, in which a piston 76 is connected to a pump hose 1 of a (high-pressure) airpump by means of a ring clamp 2. The movement of the piston 76 in the housing 77 is initiated by a turnable lever 81. The piston 76 is compressing an elastic body 78 positioned in the housing 77. This elastic body 78 has in the unloaded form two coaxially positioned cylinder shaped holes, where the hole with the biggest diameter is always positioned nearest to the opening 8 of the coupling hole 5. The hole with the smallest diameter is placed at a distance a from the coupling hole opening. Dunlop-Woods and Sclaverand valves are connected to the hole with the smallest diameter, while the Schräder valve is connected to the hole with the biggest diameter. The connection is accomplished by axially compressing the elastic body 78 and tightly squeezing it against the two thread types and in this way forming a temporary thread, which is also sealing the connection. In unloaded condition, the holes have a diameter which is a major diameter of the external thread of the valves. In compressed condition, the diameter of the holes depends on the area of the underside of the piston on the rubber cylinder, and the radial positioning of this area on the rubber cylinder. The same applies for the length of the coupling places and their positioning in relation to the opening of the coupling hole. Experiments have shown that the size of the area has no significant influence on the quality of the fastening function. It is necessary to press from the outside inwards on top of the rubber cylinder. However, there is a minimum limit for the above-mentioned area. Otherwise, the thread of the 'ball valve' (in the Dunlop-Woods valve) cannot be mounted firmly enough. The size of the area has a big influence on the forces which must be used to operate the lever and with the above-mentioned minimum, even children can use it with only one hand. The form of the coupling places when the rubber cylinder is compressed without squeezing against a valve thread, is shown on fig. 9 with dashed lines. The diameter of the air supply hole 75 is of such a size that the 5V2 thread is stopped at its end, so that a connected Sclaverand valve is always correctly positioned in relation to the coupling place 79 of the rubber cylinder.

The eighth construction example, which is shown in fig. 13, is almost the same as the seventh construction example which, however, is built-in at the end of a (high-pressure) hand pump. To reduce the size of the pump when it is not used, the function of the lever is reversed in relation to the seventh construction example, and it fits ergonomically well with the coupled hand pump. By using the pump as the long arm for the neutralizing force moment, the user can easily neutralize the force moment which is created when the lever is used.

The ninth construction example, shown in fig. 10, is an improvement of the seventh construction example.

The lever is now operated with the lowest possible force and the (dis-)connection is now free of the force moment in relation to the valve, as the hose connection with hose 1 and ring clamp 2 now form an arm, which can neutralize the torque moment from the lever. The operations are therefore even easier. The connection is air-tight and the operation only requires one hand for (dis-)connecting purposes. This is solely obtained by the improved construction of the lever. The rest of the construction is unchanged. The lever is now rounded on the spot where it is pressing at the piston top. The elastic body is only compressed to the necessary extent: the maximum force is now reduced. Moreover, the lever is now positioned in an angle of 45° with the centre line of the ring clamp. Ergonomically, this is more suitable to the thumb finger (on the lever) and the forefinger (under the ring clamp) of the same hand. Both characteristics make it possible to press the lever down without influencing the position of the housing in relation to the valve. That is why no force moment is being transferred to the valve. This is a big advantage for a comfortable operation, as mounting is established correctly every time. The length of the coupling places is short and the walls are flexible, so that it is not possible to transfer force moments of a significant value to the valve, without disconnecting the coupling. As the lever axis centre is not placed on the centre line of the coupling hole, the lever has to be fastened in a stressed position. Another consequence is that the lever automatically returns to its rest position. It is braking itself, as the underside of the lever under the axis is flat. (Dis-) connecting is done in the following way. With one hand, the thumb finger is placed on the end of the lever and the forefinger under the ring clamp. Then the housing is positioned on the valve and it is pressed as much as possible. Subsequently, the thumb and the forefinger are pressed together until the lever is placed parallel with the centre line of the ring clamp. The connection is established when the lever is pressed down, so the lock arm can keep the lever in place. The user can let go now. When disconnecting, the lever is pressed down a little bit. This removes the load from the lock arm on the lever. With a little push from the tip of the forefinger placed under the ring clamp the lock arm is released and the lever automatically turns back to the rest position as a consequence of the expansion of the elastic body. It is also possible just to press down the lock arm, after which the lever automatically jumps up and releases the connector. The connector can now be removed from the valve. Lock arm, spring and axis around which the arm turns, can be made of one piece of die cast material. The lever is an U shaped clamp.

The tenth construction example, shown in fig. 11A and 11B, is a connector which is an improvement of the seventh construction example, as it is now equipped with a movable pin. Now a Schräder valve can always be operated with the connector and therequired pumping force has been significantly reduced. The pin 21 is built-up and works in the same way as in the fourth construction type, except that it is mounted at the top of the piston and thus moves with it during the connection. Depending on the area of the underside of the piston against the elastic body, coupling places can move concurrently with the pin. To provide space for the pin, the lever is shaped as a U clamp. No matter whether the connection has been established or not, the user can turn the pin in the required position if the lever is in the bottom position.

The eleventh construction example, shown in fig. 12A,B,C, is a 'squeeze-on' type connector, which is an improvement of the ninth construction example. The pin 142 is built-in analogously with the sixth construction example and the connector is force moment-free as in the case of the ninth construction example. Untight conditions are thus avoided, just as the (dis-)connection is done in a considerabl easier way. The housing is slightly higher to provide space for the pin feed mechanism. The knob is mounted on the piston 138 by means of an edge 135 on the underside of the cylinder 136 fitting in a recess 137 at the underside of piston 138. On both sides of the housing there are valve symbols 71, 72, 73 using the knob position to illustrate what kind of valves the connector can be coupled to.

The twelvth construction example, shown in fig. 14A and 14B, is a 'squeeze-on' type connector provided with a built-in pin at the end of a (high-pressure) hand pump. It is an improvement of the eighth construction type. A Schräder valve can now always be operated with the connector, and the pumping force has been significantly reduced. The pin construction is the same as in the eleventh construction type. Here too there arevalve symbols 71, 72, 73 on both sides of the housing.

In fig. 1 the pump hose 1 is mounted on the housing 3 by means of the ring clamp 2. The housing 3 is bent in an angle of e.g. 30°-60° in relation to the centre line 4 of coupling hole 5. The bushing 6 is in the shown construction example equipped with two ISO thread types: 5V2 thread 7 starting farthest from the opening 8 of the coupling hole 5 and 8V1 thread 9 starting at the above-mentioned opening. At (dis-)connection,the bushing 6 is turned around and is kept in the grooves 11 of the housing 3 by means of grip-

hooks 10. The gasket seals 12 and 13 are tightening against the thread types 5V2 and 8V1. The gasket seal 12 is also tightening the crossing 14 between the housing 3 and the bushing 6 when the connector is used on a Schräder valve. The underside of the bushing 6 is equipped with a taper 15.

Fig. 2 shows a second construction example with an unbent housing 16 at the end of a hose 17 of a (high-pressure) hand pump.

Fig. 3A shows a third construction example. The housing 190 is equipped with a coupling bushing 191, which freely and without friction can turn around the housing 190 because of the small space b between the top gasket seal 192 and the bushing 193 together with the connector bushing 191. The gasket seal 194 for the Schräder valve is placed freely in the connector bushing 191, on the thread 8V1 195. The bushing 193 with the 5V2 thread is unattached but axially moveable in a taper milling 202 in connector bushing 191. Both can be shifted parallel with the centre line of the valve. The sealing means 200 is embedded in a stepped milling 201 in the housing 190 with an external part 192, which is also tightening the crossing between the housing 190 and the connector bushing 191. The bushing 193 can turn together with the connector bushing 191 as it is equipped with at least two ribs 196 which fit into corresponding grooves 197 (fig. 3B) in the connector bushing 191. When a Dunlop-Woods or Sclaverand valve is connected, the sealing means 200 is tightening on the minor diameter of the valve thread. The valve is stopped at the edge 198, so that the nut of the Dunlop-Woods valve is not fastening itself on the underside 199 of the 8V1 thread. At the top, the sealing means 200 has a radially stepped, reduced diameter.

Fig. 4A and 4B show a fourth construction example, where the pin is at the top position 18 and bottom 32 position, respectively. At the top of the housing 19, there is a thread hole 20 in which the pin 21 can be moved and fastened. The pin 21 moves concentrically around the centre line 4 of the opening 8 of the coupling hole 5. The thread 25 has a big pitch. The connections are made air-tight as the thread 25 ends in an elastic, conically formed gasket seals 26 and 27. The gasket seal 27 centres the pin 21 with the end 29 by means of a conical hole 28 in the housing 19. The other side of the gasket seal 26 is equipped with a cone 30. The top 31 of the pin 21 is made of a flexible material which can catch shocks. The pin 21 is made of impact-free material.

Fig. 5A and 5B show the connector according to fig. 1, where the pin 161 is built-in in the knob 162, which is kept in a groove 160 of the housing 164 by means of grip-hooks 163. The knob 162 is equipped with internal thread 165 with a big pitch. When the knob 162 is turned around, the pin 161 is shifted axially on the centre line 4 of the opening 8 of the coupling hole 5, as the pin 161 is equipped with fins 166 running in slits 167 of this hole 5. Sealing is done with one gasket seal 168. The knob 162 is made of e.g. elastic material. The pin 161 is shown in fig. 5A in the top position 18 and in fig. 5B in the bottom position 32.

In fig. 6A - 8 the pump hose 1 is connected to the housing 35 by means of the ring clamp 2. The angle α between the centre line 36 of the ring clamp 2 and the centre line 4 of the opening 8 of the coupling hole 5 is e.g. 30°- 60°. The bushing 6 with internal thread and gasket seals is identical with that of fig. 1. The pin 40 can move along the centre line 4 of the coupling hole 5 from position 18 to position 32, when the knob 43 is turned from position 44 (fig. 6A) to position 45 (fig. 6B) and in reverse. On the underside, the knob 43 is equipped with radially internal, rotating jut 46 surrounding a corresponding bulb 47, and it is locked pivotally in position 44 and 45 when the knob 43 catches the bulb 47: see section X-X (fig. 7). The cylinder 48 is directly connected to the knob 43. In the cylinder 48 there are two slits 49, 50 of which one 49 is open on the opposite side of the knob 43. The two round protrusions 51, 52 of the pin 40 are moving diametrically opposite each other in the slits 49, 50. At both ends, the slits 49, 50 with the centre lines 53, 54, which are parallel to the centre line 4, have two slits 55, 56, 57, 58, which are placed diametrically opposite each other, where the centre lines 59, 60, 61, 62 lie perpendicularly to the centre lines 53, 54. The slits 55, 56, 57, 58 end in a half circle, of which the centre 63, 64, 65, 66 lies slightly further from the closest side of the slits 49, 50 than the radius of the protrusions 51, 52. Moreover, the protrusions 51, 52 are moving in the internal thread 67 from the coupling hole 5. The thread pitch 67 is so big that the turning knob 43 only has to turn approx. 240° from position 44 to 45 or in reverse. When the knob 43 is turned, the slits 49, 50, 55, 56, 57, 58 push the protrusions 51, 52 in the thread 67. The turning knob 43 is fastened on the housing 35 by means of grips 68, which are moving behind an internal jut 69 in the knob. The abovementioned construction becomes air-tight by means of a gasket seal 70 at the top of the housing 35. On the sides of the housing 35 at the positions 44 and 45 there are symbols 71, 72, 73 of the valve types which can be connected.

In fig. 9, the pump hose 1 is connected to the piston 76, which moves in the housing 77, by means of clamp ring 2. An elastic body 78 with coupling places 79 (for the Dunlop-Woods and the Sclaverand valve) and 80 (for the Schräder valve) is compressed by the movable piston 76 by means of a lever 81, which is pressed down from the top position 82 to the position 83 where it is parallel with the centre line 36 of the ringclamp 2. The lever 81 turns around the axis 85 which is mounted in the housing 77 and to which the axis centre 86 is perpendicular and which intersects the centre line 4 of the opening 8 of the coupling hole 5. The coupling surface 79 lies at a distance a from the opening 8 of the coupling hole 5, while the coupling surface 80 is adjacent to this. The area 90 on the elastic means 78 bears against the piston 76. The piston air supply hole 75 has a diameter which is slightly smaller than the major diameter of the external thread 5V2, so that the Sclaverand valve has a natural stop at its connection. Thus the coupling place for the 5V2 thread is around the 5V2 thread.

In fig. 13 the solution of fig. 9 is directly mounted at the end of the cylinder 91 of a (high-pressure hand pump). The difference is that the lever 92 is now in rest position 82 and compressed position 83.

In fig. 10, by means of a clamp ring 2, the pump hose 1 is connected to the piston 76, which moves in the housing 110. An elastic body 78 with coupling places 79 (the Dunlop-Woods and the Sclaverand valve) and 80 (the Schräder valve) is compressed by the movable piston 76 by means of a lever 102, which is pressed down from the top position 82 to the position 83, where it is parallel with the centre line 36 of the ring clamp 2. The lever 102 turns around the axis 85, which is mounted in the housing 110 and where the centre 107 of the axis is not placed on the centre line 4 of the opening 8 of the coupling hole 5. When the lever 102 is pressed down to position 83 where it is parallel with the centre line 36 of the ring clamp 2, a lock arm 111 is activated by a protrusion 112, which by means of a spring 113 and an axis 114 in the arm 111 locks the lever 102 with a locking catch 115. When disconnecting, the lever 102 is pressed slightly down to position 116 and the lock arm 111 is pushed to position 117, so that lever 102 can be released. It now automatically turns back to the rest position 82, because the elastic body 78 returns to the unstressed condition. This is possible because the end 118 of the lever 102 at the top 119 of piston 76 is round, and top 119 of the piston is flat and because the axis centre 107 is not on the centre line 4 of the opening 8 of the coupling hole 5. The turn of the lever 102 stops when the end 120 of the lever 102 stops against the flat top 119 of the piston. The lock arm 111 is turned back by the spring 113 until it meets against the stop 121. The top of the lever 102 is in rest position 82 under an angle Ψ of approx. 45° with the centre line 36 of the ring clamp 2. At the opening 8 of the coupling hole 5, the housing 110 is equipped with a cone 15 which facilitates the mounting of the universal connector.

Fig. 11A and fig. 11B show the tenth construction example which is a combination of the connector of fig. 9 and the construction of the pin of fig. 4A and fig. 4B, where the pin 21 is in the top 18 (fig. 11A) and bottom 32 (fig. 11B) position, respectively. The construction of pin 21 and the way it works is the same as in the fourth construction example, except that it is mounted on top of the moveable piston 125, which moves on the centre line 4 of the opening 8 of the coupling hole 5. The pin 21 is at the end equipped with a cone 130 to catch the plug pin more efficiently. The lever 131 is U-shaped.

Fig. 12A, 12B, 12C show the eleventh construction example which is a combination of the coupling of fig. 10 and the construction of the pin of fig. 6A, 6B, 7, 8. In fig. 12A, the pin 142 is shown in its top 18 position and in fig. 12B in its bottom 32 position. The construction of pin 142 and the way it works is the same as in the sixth construction example, except that it is mounted on piston 138 by means of an edge 135 on the underside of the cylinder 136, which fits in a recess 137 from the underside of the piston 138. The construction of the pin becomes air-tight by means of a gasket seal 139 between the turning knob 140 and the cylinder 136. The turning knob 140 is equipped with a line 141 showing the knob 140 position. The valve symbols 71, 72 correspond to the position 18 of the pin 142 and the symbol 73 corresponds to the position 32 of the pin 142 resp. The turning knob 140 is fixed at the valve symbols 71, 72, 73 when the piston fits in a recess 145 in the knob 140 with a bulb 144: see section A-A in fig. 12A and section B-B in fig. 12B, resp. Here too, the opening 8 of the coupling hole 5 has the centre line 4.

Fig. 14A and 14B show the twelvth construction example which is a combination of the connector from fig. 9 and the pin construction from fig. 12A, 12B og 12C. The high pressure hand pump is shown with a connector at the end with an lever 152 in resting position 82 and stressed position 83. The opening 8 of the coupling hole 5 has again centre line 4. Fig. 14A shows pin 40 in top position 18 and fig. 14B shows pin 40 in bottom position 32.

Fig. 15 shows Dunlop-Woods stem 175 with a DIN normed plug 176 connected to the universal connector 174 from fig. 6A, 6B, 7 og 8.

Fig. 16 shows the same as fig. 15, except that plug 177 is a 'ball valve' plug.

Fig. 17 shows a Sclaverand valve 178 connected to the above-mentioned connector 174.

Fig. 18 shows a Schräder valve 179 connected to connector 174 - the pin is opening the plug pin.

Fig. 19 shows Dunlop-Woods stem 175 with a DIN normed plug 176 connected to the universal connector 180 from fig. 12A,B,C.

Fig. 20 shows Dunlop-Woods stem 175 with a ball plug 177 on the universal connector 180 from fig. 12A,B,C.

Fig. 21 shows a Sclaverand valve 178 on which the universal connector 180 is coupled.

Fig. 22 shows a Schräder valve 179 connected to the universal connector 180 where the pin is opening the plug pin.